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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Textile Machinery

Improvements in Design and Methods of Lubrication

PUBLISHED BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

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(Continued on Inside Back Cover)

THE TEXAS COMPANY
Texaco Petroleum Products
135 East 42nd Street, New York City

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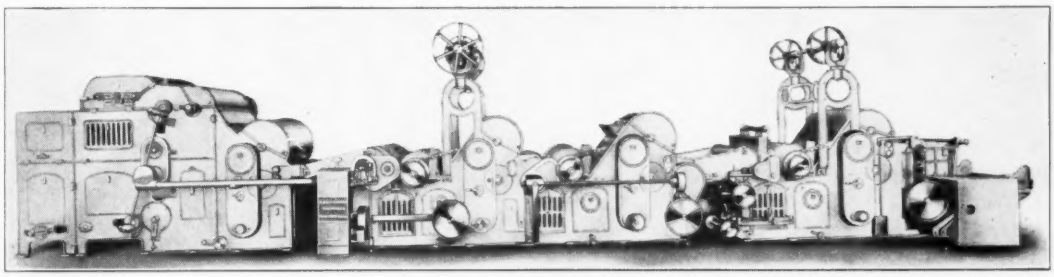
Textile Machinery

Improvements in Design and Methods of Lubrication



Courtesy of H. & B. American Machine Co.

Fig. 1—Showing an H. & B. single process picker. This machine is equipped with 16 ball bearings with provision for automatic lubrication wherever practicable.

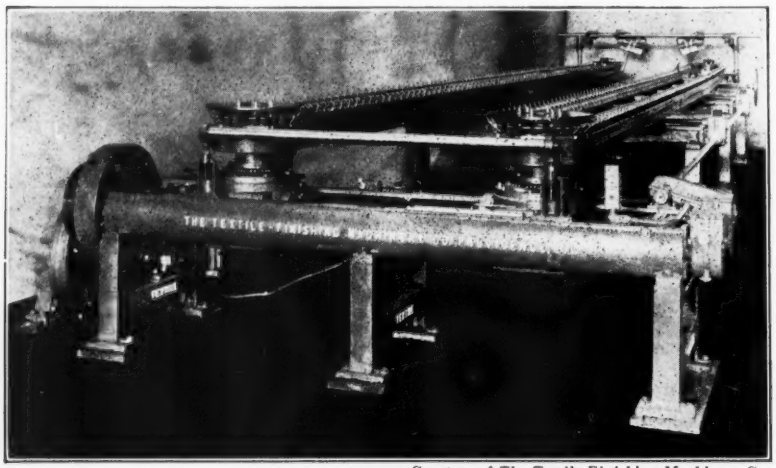
THE textile industry is distinctive for the interest which machinery manufacturers have shown in machine improvements.

Stability in machine performance can be materially influenced by the thought which is given to lubrication when the unit is in the drafting board stage. Builders of textile machinery have come to realize this fact more and more fully during the past few years. The lull in demand for replacement units has been beneficial in this regard, in that it has allowed more time for practical research covering the value of improvements in design and their relation to protection of moving parts and methods of lubrication.

In some cases the resultant changes have been a wide departure from heretofore accepted practice in design. The ball bearing has been found to be admirably adapted to certain parts of winders, spinning frames and finishing machinery; worm gear drives on tentering frames have been enclosed in oil-tight housings equipped with suitable cooling fins; collar oilers have been applied to sleeve type bearings, to assure of automatic lubrication and prevention of contamination; and pressure grease lubrication has been extended until the lubrication diagram of some machines resembles that of an automobile chassis.

The value of such improvements to the mill owner and machine operator and lubricating engineer is inestimable. The former saves money by reduction in cost of lubricants, oil contaminated goods, injury to workers and decrease in repair expense. The worker profits by better health conditions, less chance of lost time due to accidental slipping in pools of

dripped lubricants, and less responsibility in regard to machine maintenance. Furthermore, the greater probability of being able to offer more positively the most suitable lubricant for specific operating conditions, enables the lubricating engineer to become a true consultant to his mill customers.



Courtesy of The Textile Finishing Machinery Co.

Fig. 2—End view of a tenter machine used for stretching fabrics and bringing them to the desired width. Ball bearings are used extensively on this machine. Gearing is totally enclosed, in the interest of protecting lubrication. Design of the chain rails has also been studied from this viewpoint, the outer lip of the rails being continuous even around the ends.

OPERATING CONDITIONS

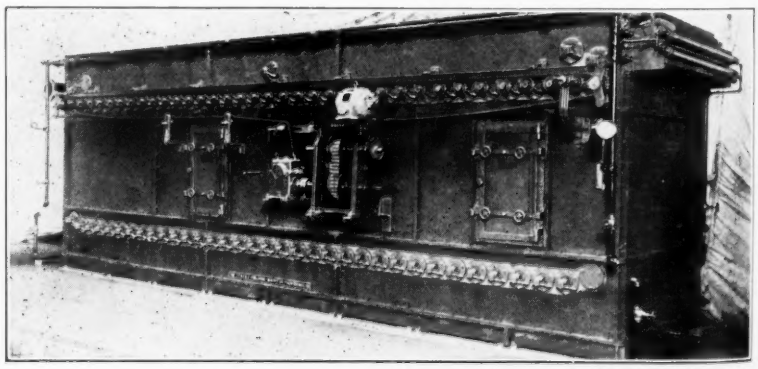
There must be thorough understanding of operating conditions throughout the mill. This will hold true regardless of whether cotton, wool, silk or rayon goods are being manufactured, for operating conditions become a distinct guide as to the type of lubricants which should be used. Power economy and protection of product are always uppermost in the mind of the textile executive. Their relation to lubrication is obvious. In realization of this fact petroleum research has been most recently directed toward the development of low torque greases and products which, by reason of their high lubricating value, will require the minimum quantity for lubrication, thereby reducing the possibility of leakage and oil-spotted fabrics.

Grease research has been especially interesting in view of the trend toward adoption of the ball bearing. The results have been decidedly gratifying. Laboratory tests have proved that low starting and running torques are no longer an ideal, while practical service tests have checked the laboratory by the resultant lower operating temperatures which have been observed. The chemical characteristics of such greases also render them readily emulsifiable and therefore capable of being washed out from goods should spotting occur. These same characteristics also give high melting points with but little change in consistency, properties which are especially beneficial where lubrication of the bearings of dryers, tentering frames and other high temperature service is necessary.

Dust and Dirt Contamination

The earlier stages of materials handling in certain textile mills will generally present the problem of contamination of lubricants. In the formative and finishing stages prevention of oil-spots on yarn and fabric must be carefully studied.

In handling such raw products as cotton, and the cellular material which forms the basis of rayon, it must be remembered that they may contain a considerable amount of dust, dirt or fluff as they reach the mill. In the cotton mill the operation of the opener or bale breaker will set free much of this dust and loose ends. It will also often be found in carding operations. Hence the provisions in the modern mill for dust retention and accumulation. Material of this nature is not always abrasive. It is, however, decidedly non-lubricating, and an element in the development of static electricity. This latter may become a serious hazard due to

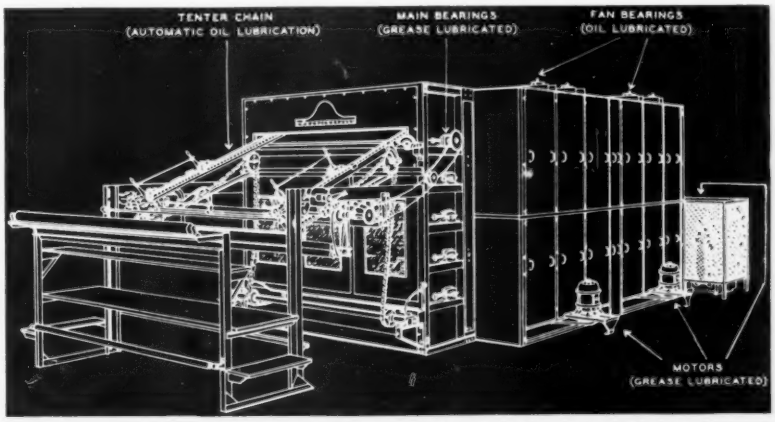


Courtesy of The Textile Finishing Machinery Co.

Fig. 3—Showing a standard Universal type of ager used in the development of colors on printed fabrics. SKF ball bearings are used extensively throughout this machine for top driven rolls and carrier rolls. All such bearings are located on the outside of the box.

the possibility of explosions if dust is present in the air to any extent.

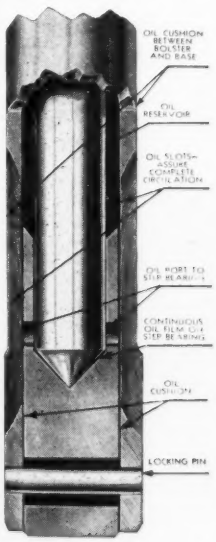
Dust and dirt may impair lubrication by accumulating in lubricators, piping, within bearing clearances, around chain links and on all other exposed moving parts. This possibility is being fully realized by builders of machinery, lubricating equipment and bearings, to such an extent that today every provision is made to prevent entry of foreign matter and enable positive delivery of lubricant. The waste-packed bearing type of oil lubricated mill motor, and the double seal ball bearing have been noteworthy developments in this regard. In fact, the conventional oil hole and hand oil-can so familiar on older types of machinery are rapidly being discarded, even on such machines in favor of pressure grease fittings, automatic sight feed oilers and other unit devices which can be readily screwed into existing oil holes.



Courtesy of James Hunter Machine Company

Fig. 5—Hunter automatic cross-draft tenter, showing operating parts and provision for automatic oil lubrication of the tenter chain and protected lubrication of other bearings.

Temperature a Factor



Courtesy of Saco-Lowell Shops

Fig. 4—Enlarged section through a loose locked step Saco-Lowell spindle. All parts are clearly indicated.

In finishing processes one must also realize that there are many places where higher temperatures will prevail. The enclosed tentering frame, certain designs of calenders and the drying machinery used for virtually all types of textiles will almost always present a temperature condition which must be studied by both the bearing designer and lubricating engineer. High temperatures will present the possibility of overheated bearings, especially if lubrication is not effective or where a lubricant unsuited to such temperatures is used. Frequently this may result from too much consideration of low cost. Obviously a specially prepared, high temperature grease, or highly refined steam cylinder oil of adequate body to resist the viscosity reducing effect of temperature, will cost more than a cup grease or machine oil. The increase in cost, however, is excellent insurance against bearing failure, and when weighed against the probable cost of bearing replacements should be fully justified. This will be especially true where costly ball bearings are involved, which may require considerable disassembly of the machine for replacement.

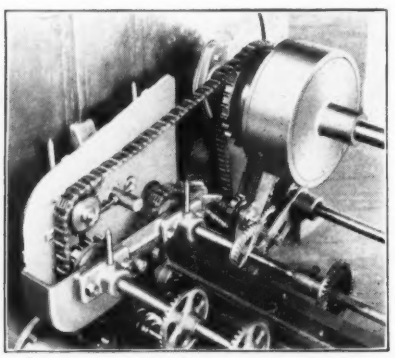
On the other hand, where an adequate supply of heat-resisting oil or grease is maintained, lubricating difficulties will be markedly reduced. Normally temperatures at the bearings will seldom range above 250 to 300 degrees Fahrenheit. It will depend entirely upon the pressure of steam used for drying purposes or the proximity of the bearings or chain links to open flame as in the enclosed tenter frame or singeing machine. On such equipment there should be no question as to use of special high temperature lubricants.

Water and Acids

Lubrication of dyehouse and ageing machinery must be studied from the angle of the possibility of contamination with water and chemicals such as acetic acid. Water will exert a washing effect which may lead to bearing corrosion and premature wear if the lubricant is not capable of withstanding this effect. It has been found that use of oils of emulsifying tendency, or greases compounded with soaps of low solubility is beneficial whenever water may be present. Where acids may be present grease lubrication is advantageous, provided the grease is so applied as to effectively prevent such acids in either fluid or vaporous form, from coming in contact with bearing metals or other parts. Ager boxes where acetic acid is used may present a particularly troublesome problem if this occurs. Cases have been observed where ball bearings, for example, have

been virtually disintegrated due to inability of the means of lubrication to retain oil within the bearings. Certain of such problems have been effectively solved by using a medium consistency acid-resistant grease, with means for frequent renewal.

Manufacturers of ball and roller bearings have given very thorough study to this matter of protecting their products from water and acids by means of a variety of very effective seals. These latter serve not only to keep out such contaminants to a great extent, but also, by the very reason of their tightness, they retain grease quite satisfactorily, thereby to assure of a protective film of lubricant on all bearing parts, irrespective of external influences. For this reason, the builders of dye house and textile finishing machinery have largely standardized on such types of bearings, to the obvious benefit of their customers, as well as the manufacturers of lubricants, who profit by the reduction in complaints which at first sight, in the past, have often been attributed to faulty lubrication.



Courtesy of Saco-Lowell Shops

Fig. 6—Showing the new Saco-Lowell roving frame "horsehead" or bobbin driving mechanism. Note that this design includes a silent chain drive arrangement for the improvement of running operation, reduction of repairs and better lubrication.

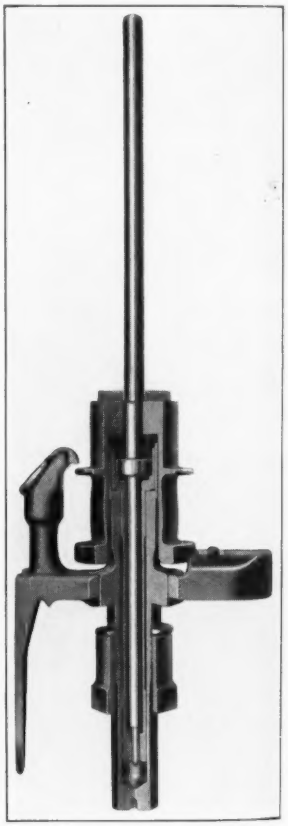
Improved Lubrication Decreases the Fire Hazard

Opening machinery in the cotton industry has always received very careful consideration from a lubrication viewpoint, in the interest of reducing frictional temperatures as far as possible. Spontaneous combustion must be carefully guarded against in the preliminary handling of cotton; it is always a potential hazard where there is considerable dust or fly present in the atmosphere. Oil or grease drippings, together with higher bearing temperatures, increase this hazard in the event of sparks or arcing of electric motors.

This has led the industry to lean very favorably toward the induction type of mill motor, the installation of sealed-type ball and roller bearings, and study of methods of automatic lubrication. Use of the anti-friction bearing automatically permits of positive and dependable lubrication where housing and seal design have been studied to enable proper retention of lubricant. If this latter is then selected in accordance with operating temperatures, pressures and speeds, and care observed not to overfill the bearing housings, cleanliness should be a natural sequence, for drip or leakage should be comparatively negligible.

Whether or not to use oil or grease is a matter to be decided upon only after careful study of the installation. Straight mineral oil of varying viscosity, according to speed and bearing design, will function satisfactorily if it can be retained by the bearing seals. Otherwise, a light grease will normally be preferred. Throughout any study of such machinery, the necessity for reduction of bearing temperatures must be borne in mind; lubricant body or viscosity must, therefore, be kept as low as possible to reduce development of heat by internal friction within the lubricant itself, and prevent abnormal power consumption.

This also applies to gear lubrication. Gears require special attention, especially if they are not properly covered to protect the lubricant and prevent throwing or dripping of lubricant. Under such conditions a comparatively heavy-bodied straight mineral lubricant should generally be used. By virtue of the adhesive nature of this type of product but a very small amount will be required for maintenance of a sufficient film on the gear teeth, not only to prevent friction and wear, but also the possibility of any spark, should the teeth happen to mesh or strike each other unevenly.



Courtesy of Saco-Lowell Shops

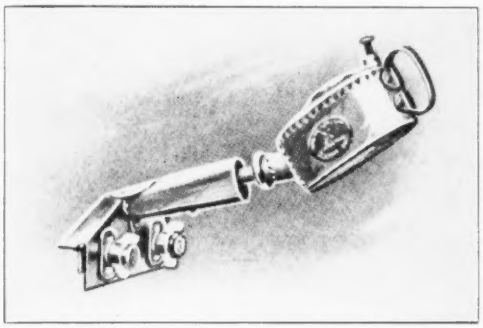
Fig. 7—Showing a Saco-Lowell high speed ball bearing twister spindle, designed to reduce vibration. Another advantage of this particular design is that it requires less frequent oiling and operates with less power consumption.

CARD ROOM OPERATIONS

Considerable dust and fly may also be present in the card room. The carding process

is applied to both the cotton and woolen and worsted industres. The essential purpose is to open out and render the fibres of the stock as parallel as possible. In the treatment of woolen and worsted stock, it follows the scouring process. The carding machine involves a number of rollers and cylinders, surfaced with numerous small wire ends. The resultant product, which resembles a rope, is known as the sliver or roving.

The construction and motion of the comb box of this machine has always presented a potential lubricating problem. The action of the doffer comb is vibratory, reciprocating

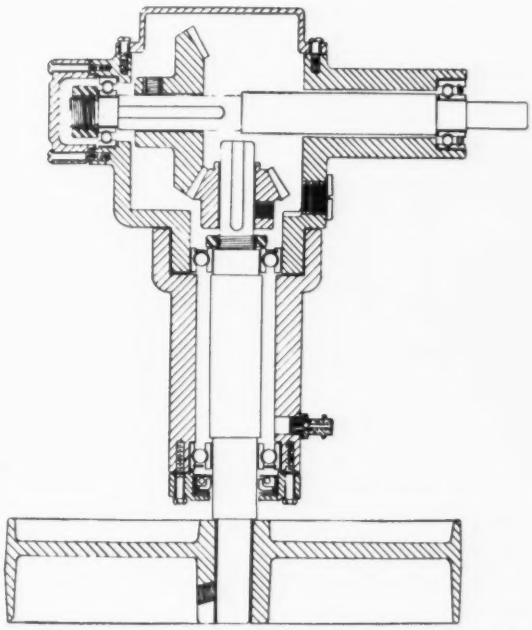


Courtesy of M. P. Williams

Fig. 8—Showing an improved type of spindle oiler, applicable to cap spinning and twisting spindles. Top view shows details of oiler; bottom view shows means of application. It is operated by placing on the rail and sliding it along to lift tubes automatically and place oil on the spindle by means of a brush.

motion being brought about by a suitable cam or eccentric mechanism, which runs in a bath of lubricant. The temperature of this latter must be as uniform as possible, due to the fact that the comb is usually set with but a few thousandths of an inch clearance between itself and the doffer cylinder. Even running of the sliver depends to a great extent upon the uniform maintenance of this clearance.

This requirement has led to consideration of a wide variety of lubricants, including both oils



Courtesy of U. S. Textile Machine Co.

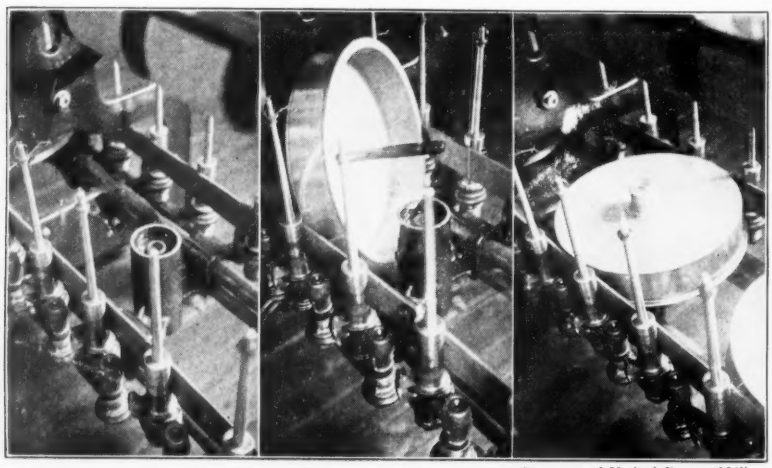
Fig. 9—Showing a back idler assembly for an Acme twister, as designed for the silk and rayon industries. Note extensive use of ball bearings throughout this design.

and greases. Unfortunately, some operators have lost sight of the relation of internal or fluid friction to temperature increase, in their preference for oils of comparatively high viscosity, or relatively heavy greases, to reduce splashing or throwing from the comb box when the lubricant is subjected to the continued churning action of the cam or eccentric mechanism. Such products may obviously lead to increase in temperature by reason of their resistance to motion, especially in cotton carding service where speeds are higher than in the carding of wool or worsted.

This is thoroughly realized by the lubricating engineer. The textile operator must also appreciate the fact that use of lubricants which are capable of readily following the comb box elements with minimum resistance to flow, will promote lower frictional temperatures and insure more positive maintenance of the desired clearance between the comb and doffer cylinder. A light to medium viscosity straight mineral oil, or a low soap-content light grease capable of resisting separation will function best in such service.

Operating temperatures may also be affected by misalignment of the comb box, and the size

or adjustment of the band. Should the latter be too small in diameter, some operators may run it too tightly. This may readily lead to increase in power consumption and working temperature.



Courtesy of United Rayon Mills.

Fig. 10—Showing an improved type of idler pulley design, whereby a comparatively small number of large idlers are used to replace the numerous small ones in silk and rayon throwing operations. Figure to the left shows the large size oil reservoir with idler removed; capacity of this reduces frequency of re-lubrication. Figure in center shows comparative size of idler and oil reservoir. Figure to the right shows the idler in place.

With this necessity for uniformity of temperature in card lubrication, it is obvious that breakage or throwing of lubricant should always be prevented; otherwise, the leather backing of the card clothing may be impaired by oil spots. Increase in the body of the lubricant is a partial remedy but not to be recommended due to the effect on temperature. For this reason, careful study is given in modern mill operation to oil-tight design of all parts of the carding machine requiring lubrication.

In order to prevent oil leakage from cylinder bearings to the card clothing on the main cylinders, study has also been given to the adaptability of ball bearings for these elements. These latter have proved their value, and when installed in seal-type housings they effectively prevent leakage of lubricants to the card clothing. Furthermore, they materially reduce the power consumption, especially on starting, when lubricated with a suitable low-torque grease, making it practicable to start a cotton or woolen card with minimum power, and practically no difficulty after shut-down.

It is, of course, practicable also to use oil where the housings of such bearings are absolutely oil-tight. Under such conditions a comparatively low viscosity, straight mineral oil of around 100 seconds Saybolt at 100 degrees Fahr., will be satisfactory. Where plain bearings are involved, however, a somewhat heavier oil will be necessary, ranging from 200 to 300 seconds Saybolt viscosity at 100 degrees Fahr., according to the bearing design, method of application and extent to which leakage might become of serious consequence.

Temperature Counteraction

The effects of external temperature become first apparent in the lubrication of the combing or drawing frame, on which the process of fibre straightening as begun on the card is continued to perfect the texture of the fibres and facilitate uniform spinning. Design of such equipment calls for location of many of the bearings and other moving parts in close proximity to the fibres under treatment. Steam heat is also employed on some types of service to bring about efficient combing. It therefore devolves upon all concerned to give careful study to the prevailing temperatures at which the operating mechanisms may function, for obviously if the body or viscosity of the lubricants employed becomes too low, due to heat, there may be considerable possibility of oil stains. In the worsted mill the daubing motion presents the most difficult lubrication problem. These motions are eccentric and designed to operate enclosed. They are quite similar to the card comb box in lubrication requirements, and operating temperatures. On the other hand, since they are located above the rotating table of the comb, the driving of the dauber which pounds the wool affords greater opportunity for oil drip to the wool than from the comb box. Operators normally regard that lubricant as most suitable which will give lowest box temperature without drip.

Lubricants of reduced viscosity may be especially apt to be thrown from the cam motions of some machines where constructon is not entirely tight. For this reason the lubricant should have sufficient body to withstand the pounding of the dauber and the thinning-down effect of higher temperatures, otherwise drip or throw-off may occur.

Revolving table roll and draw-off roll bearings also require a fairly heavy bodied lubricant which will adequately resist heat. Experience has indicated that where oil should be used a viscosity in the neighborhood of 500 seconds Saybolt at 100 degrees Fahr., will suffice. Where grease lubrication can be maintained, a product containing an oil of similar viscosity will serve very well. The trend towards the

anti-friction bearing will, of course, permit a certain amount of reduction in viscosity or consistency in the interest of reduced starting torque and power consumption in service. This will be quite practicable where sealed-type bearings are employed.

TWISTING AND SPINNING MACHINES

Spindle design, especially as adapted to the cotton industry, has been studied from the viewpoint of increasing oil capacity in order to reduce the frequency of oiling, and insure greater protection against dust and dirt contamination. More attention to lubrication and reduction in power consumption has also been necessary, due to the trend towards increase in spindle speeds. The selection of a spindle oil must, therefore, be approached in a most careful manner, for if the oil in service is unable to function with a minimum of drag, power or friction losses, excessive tension may be imposed on the yarn. Frequent breakage and high power consumption will be indicative of such a condition.

Spindle Temperatures

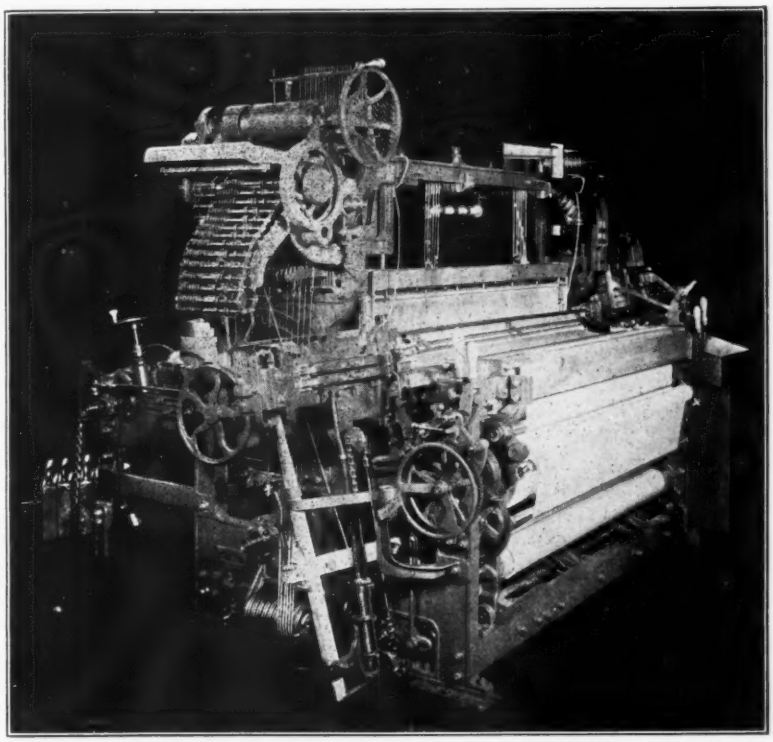
The difference which may exist between the room temperature and the temperature of spindles is a primary indication as to the lubricating and friction reducing ability of a spindle oil. The ideal would obviously be an absence of any difference in temperature. Unfortunately friction cannot be entirely eliminated. As a result, spindles will almost always operate at a temperature somewhat above that of the surrounding atmosphere.

Viscosity is, of course, an important item in this regard, for the higher the viscosity of the oil, the greater will be the internal friction, with the result that more power will be required to drive the spindles. For this reason, every care should be taken to observe and record such temperatures, and reduce the viscosity of the oil as far as possible.

Reduction in viscosity of a spindle oil should never be carried to an extreme, however, due to the possibility of metal-to-metal contact and the resultant increase in metallic friction which would cause excessive wear. The forerunner of this would be marked increase in spindle temperatures and excessive power consumption. The ultimate result would be seizing of the spindles. Long before this extreme, however, frequent breakage of the yarn will indicate impending trouble.

Cleanliness Essential

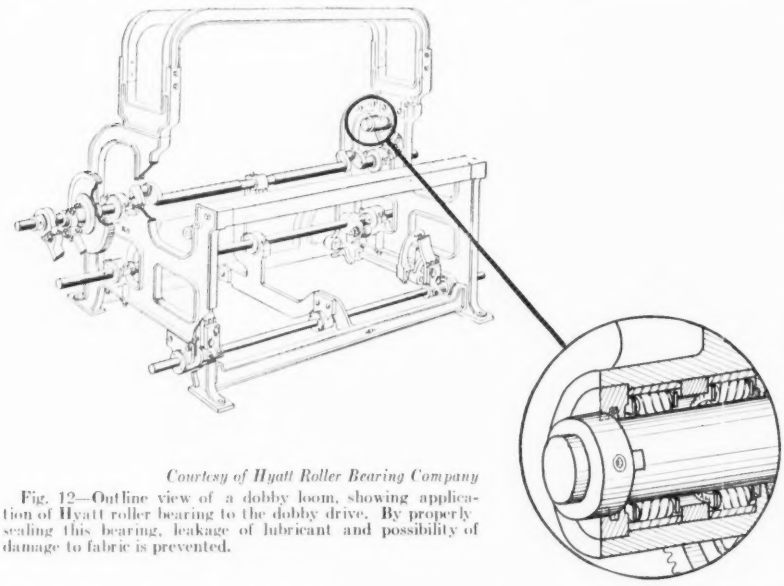
This is assured by selecting spindle oils of high refinement, and subsequently protecting them in storage and service. Contact with the yarn is always objectionable, but doubly so if the oil is dirty or of poor quality. Frequently constructional details or adverse operating conditions will render this ideal difficult to attain. For this reason, it is always advisable to use mineral oil of comparatively light color, since color is a visual indication of the degree of refinement. In full realization of the necessity for purity, the utmost care is taken in the refinement of such oils. Handling and storage to keep them free from contamination is a matter which rests in the hands of the mill operators. It can be accomplished if spindle oils are stored in clean tanks, free from dust and dirt, and handled only in clean containers when re-lubricating.



Courtesy of Crompton & Knowles Loom Works

Fig. 11—A shuttle-changing super silk loom equipped with the Knowles head motion. Improvements in this machine have been the extensive use of Hyatt roller bearings and provision for grease lubrication.

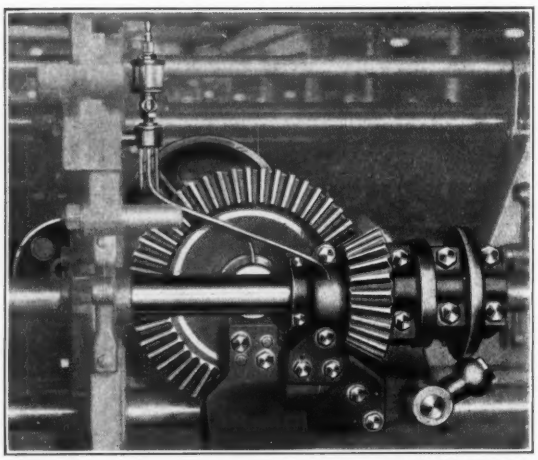
To assure satisfactory operation in service, spindle bases should be cleaned at frequent intervals and refilled with fresh oil, for a certain amount of foreign matter will always gain entry, to cause wear, increased friction, dis-



Courtesy of Hyatt Roller Bearing Company

Fig. 12—Outline view of a dobby loom, showing application of Hyatt roller bearing to the dobby drive. By properly sealing this bearing, leakage of lubricant and possibility of damage to fabric is prevented.

coloration of the oil and perhaps very serious staining of the yarn. Study of many tests has proved this practice to be beneficial in reducing power consumption. It has been observed that the latter varies directly with the degree



Courtesy of Textile Machine Works.

Fig. 13—Front view of the new "Reading" Coulier Motion. Note provision for automatic visible lubrication whereby all operating parts are served from one source of oil supply.

of cleanliness of the spindle base, ranging from 0.3 to 0.5 watts per spindle hour, according to the type of base.

Mule Frame Spindles

Spindle lubrication on the mule frame will differ but little from that of the ring or cap type frames, with the exception that the bases will usually be open. Under such conditions the possible development of oil throwing will frequently render it advisable to use a somewhat heavier spindle oil, for the oil must remain in the base, not only to insure positive lubrication but also to prevent possible staining of the yarn.

Worsted Cap Spindles

A recent development in design of such spindles provides for mechanical oiling by means of oil soaked felt, located in the rail, which lubricates the tube by wiping action. The oil supply on the felt is renewed twice a day. This must be attended to regularly, otherwise heating and seizing may result if proper lubrication is not maintained.

Another innovation provides for application of spindle oil directly to the spindle blade by means of a special type of oil can. This has shown a decided saving in labor and oil consumption, for the oil is injected immediately to the point where it is needed.

SILK THROWING A PROCESS OF SPINNING

Lubrication of the various winding, doubling and spinning machines in silk "throwing" requires careful study of spindle oils and spindle construction to reduce the tendency toward loss of oil by centrifugal force and damage to yarn. The rapidly rotating spindles of the spinning and doubling machines require the most attention, due to their natural tendency to throw oil; hence, it is most important that they be looked after by an experienced machinist who understands the principles of lubrication.

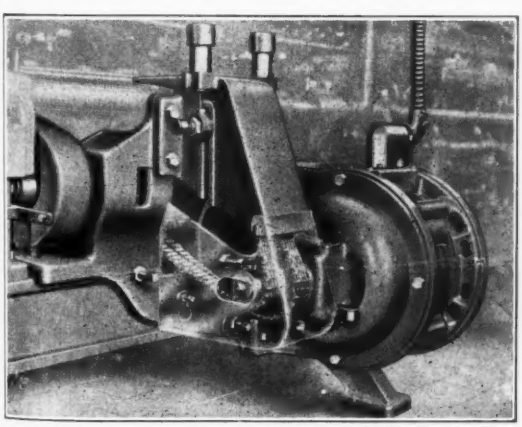
The oil level in the spindle bases is particularly important. These elements, which form the oil reservoirs, should never be more than half full of oil; otherwise, the latter will work itself upward to drip or be thrown onto the silk threads or adjacent spindles. This possibility has led many throwsters to prefer the self-oiling type of spindle. Re-oiling of spindles can be most accurately controlled by removing them and carefully filling the reservoirs with oil to the desired level. No oil should be allowed to remain on the outside of the spindle

mechanism, or to come in contact with the driving belt. This must be guarded against, especially in replacing the spindles, which should be done most carefully to avoid splashing or possible forcing of the oil on to the whorl or the belt. Many authorities consider it good practice to renew spindle oil in sequence, and not service all at approximately the same time, in the interest of better control of lubrication.

The throwing spindle will normally require a comparatively light oil which has been highly refined to render it as nearly stainless as possible. Purity is a most important factor; it can be best assured by purchasing such oils from substantial refiners of established integrity.

Other working bearings of the spinning or throwing frame can be effectively lubricated by means of a high grade of machine oil of about 300 seconds Saybolt viscosity at 100 degrees Fahrenheit, unless grease fittings and perhaps ball bearings are installed, when a medium consistency, low torque grease should be used.

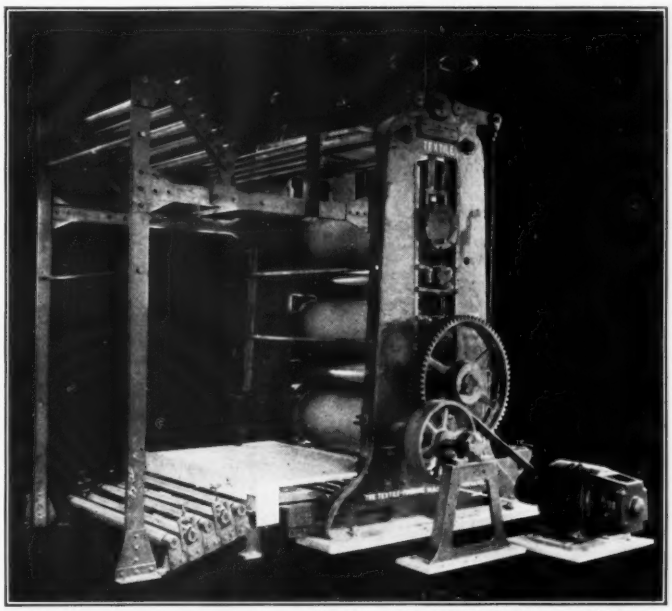
Frictional spindle drives do not require lubrication. In fact, trouble will be bound to occur if they are oiled, due to slippage, thrown oil and slack twisting, which latter may not be evidenced until the woven fabric comes from the dyehouse. For this reason the frictional drive should always run perfectly dry. Adjacent gearing and any silent chain drives which may be installed on some machines should be sparingly lubricated by means of a relatively heavy grade of liquid grease that will not drip.



Courtesy of Textile Machine Works

Fig. 14—Rear view of the disc clutch on a "Reading" full-fashioned knitting machine, showing relative location of the chain drive. Note the manner in which this drive is housed to insure protection of lubrication.

Where ball bearings are installed on the heavy elements of spindle belt drives, etc., the lubricant should be a light bodied grease free from acid and alkali, and capable of functioning with minimum torque, or power consumption.



Courtesy of The Textile Finishing Machinery Co.

Fig. 15—Showing a modern five-roll calender with top and bottom rolls equipped with roller bearings. Ball and roller bearings are also used elsewhere on this machine, wherever practicable. This permits of more dependable lubrication and gives better insurance against leakage of lubricant or faulty bearing operation through impaired lubrication.

Idler Pulleys

Study of the function of idler pulleys on throwing machinery has led to the interesting conclusion that the numerous small idlers which back up the belts can be efficiently supplanted by a few large pulleys which extend clear across the frame. Each of these large pulleys is equipped with an oil reservoir of approximately one pint capacity. As a result, very infrequent relubrication is necessary, moving parts are more positively protected, there is less chance of the reservoirs running dry, and replacement of idlers is reduced to a most gratifying extent.

Slow Speed Machinery

The silk mill, of course, includes other machinery, such as winding frames, doublers, reels, warpers and water stretchers, etc., but these units operate at considerably slower speeds than do the spinning or throwing frames. For this reason they will seldom present any lubricating difficulties if the lubricants have been properly applied. Hand oiling of most bearings and gears is still customary, the machine oil and gear lubricant used in the spinning room being suitable. There is comparatively little mechanism between the supporting frames of such machines which requires lubrication,

hence the chance of damaging the silk by dripped oils is reduced.

Tram Rings

Tram rings must function with the least possible rise in frictional temperature. Lubrication daily with a light consistency, comparatively stainless grease is conducive to such operation. These rings are an important part of throwing equipment, and frequently may give rise to trouble, due to the excess heat generated by virtue of the work they do. Their lubrication is best accomplished by putting grease in the palm of the hand and applying it to the rings with a finger or flexible swab. The throwster should be careful to avoid excessive lubrication of such rings, due to the possibility of yarn or thread stains when dirt or grit has accumulated on the inside surfaces.

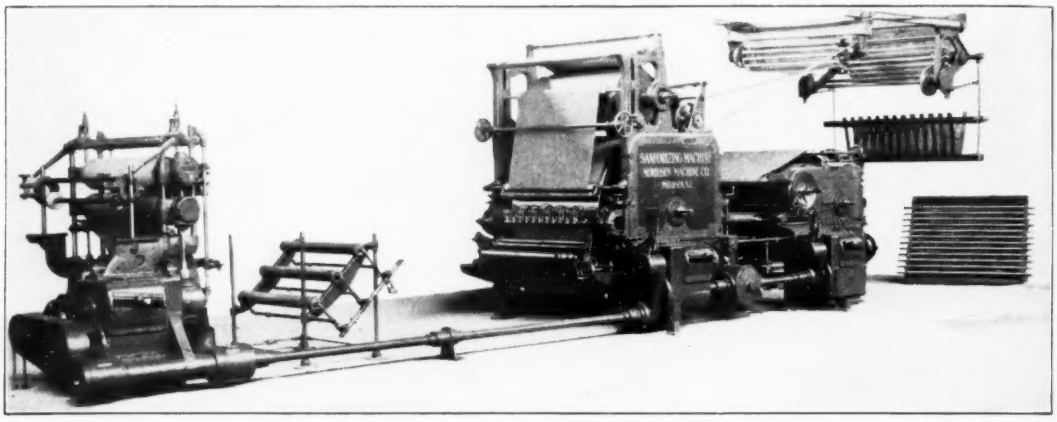
Care of Belting

Belts should also be kept absolutely free of oil and grease; otherwise, slippage and deterioration will be bound to occur. If they should become oily, the free oil can usually be absorbed by holding chalk or whitening against the moving belt. The surface should then be carefully scraped with a dull knife, to remove all such foreign materials which might interfere with transmission of power.

LOOM SERVICE

The primary thought in the lubrication of weaving machinery is to prevent oil or grease from coming into contact with the yarn or goods at any stage of the process. In fact, oil stains may be so serious where costly fabrics are being manufactured as to lead to a decided tendency among some operators to underlubricate their equipment, thereby taking a chance on excessive wear. This has been fully realized by loom builders in their study of protective means of lubrication.

The result has been a decided trend towards automatic lubrication in the design of modern weaving machinery, oil circulating systems and pressure grease appliances being carefully considered. On such machines manual control is still essential, but at less frequent intervals than where hand oiling is necessary. In many plants each machine operator is responsible for the lubrication, operation and production of his own machine. Others consider it best practice to have lubrication taken care of by the loom fixers in charge of the section, in the interest of centralizing responsibility and improving machine economy. Uniformity in application of lubricants is most important; to this end assignment of one or more qualified mechanics to take care of all plant lubrication is being looked upon very favorably.



Courtesy of Morrison Machine Company.

Fig. 16—Showing the type of machinery used in the process of Sanforizing. This machine is fully equipped with ball bearings. Some of these elements are pre-packed with a comparatively heavy bodied lubricant. Others are designed for automatic pressure lubrication.

The nature and construction of the wearing elements involved will, of course, have an influence upon the frequency of lubrication and the manner in which this can best be accomplished. For smaller bearings, a high grade machine oil of approximately 300 seconds Saybolt viscosity at 100 degrees Fahr., will be suitable. For the lubrication of larger bearings, such as on rolls, the use of a somewhat heavier lubricant may be advisable. Frequently a good grade of light grease will give best results, and the trend is to provide lubricating devices to handle such a product.

Gears and chains, in turn, will require considerable care in their lubrication, to prevent dripping or throwing of the lubricant on to the woven goods. For this reason a fairly adhesive grease will generally give best results, although it is perfectly practicable to use a relatively heavy oil if it is sparingly applied.

Both gears and driving chains of the so-called silent type, if located in relatively oil-tight casings, will probably function best if lubricated with a straight mineral oil of approximately 100 to 150 seconds Saybolt viscosity at 210 degrees Fahr.

Jacquard Machines

Oil is still preferred for Jacquard machines by the average operator. Regular and controlled application is highly essential. It should never be poured in excess upon the wires, cylinder hammers or other working parts of such a machine, due to the fact that it will at best have a certain tendency to run or drip down on to the harness connections. The presence of oil on these latter will tend to promote deterioration of the cords and result in breakage. In extreme cases such oil might even drip on to the warp or woven fabric, causing oil spots and perhaps ruining it, or, in any event, entailing additional time and expense in subsequent removal. For this reason, it is advisable to install oil pans upon the Jacquard machine supports wherever possible, and see that they are kept clean and free from dust and dirt at all times.

A light viscosity, stainless textile oil, or a high grade liquid grease, will function best on such equipment. The latter is preferred by some authorities due to its non-dripping tendency. Many mill operators, however, use the same grade of machine oil as on the loom mechanism. In the event of oil drip pans being installed, such a lubricant would serve the purpose quite well, yet there is still an element of danger attached to the possibility of oil spots occurring, whatever the precautions.

KNITTING FRAMES

Manufacturers research in the study of lubrication of knitting machinery has indicated that by more effective bearing design and application of protective measures the number of lubricants heretofore deemed necessary can be considerably reduced. Automatic lubrication has been adopted wherever practicable to assist in protection of bearings, gears and chains, and prevention of oil stains.

Cost of production is a most important item in the knitting mill. Power losses due to friction or incomplete co-ordination of motion, the high cost of replacing parts, or the necessity of discarding garments due to oil stains, must therefore be prevented. The use of properly refined lubricants, which will show minimum internal friction and still protect the moving parts is an important adjunct to satisfactory production.

All flat bed knitting machines such as the weft type full-fashioned machine, and the warp type Tricot, Milanese, and Jacquard Raschel machines will require careful lubrication of the needle, guide, sinker and presser mechanisms. In general, the lubricant, which should be a very highly refined product must be carefully and sparingly applied to prevent access to and possible damage of the fabric. The normal viscosity range for such an oil will be from 75 to 100 seconds Saybolt at 100 degrees Fahr.

Cams and other operating mechanisms, including bearing boxes, will, however, require a somewhat heavier oil, similar care being exercised in its application. Such other operating parts as frame bearings, motors, driving gears and chains are less apt to cause damage to the fabric through faulty lubrication; yet to insure economy and maximum production their lubricants must also be carefully selected and applied. For roll and motor bearings a straight mineral oil of from 180 to 200 seconds viscosity is recommended. For gears and chains a medium consistency grease will serve the purpose admirably, although some builders also suggest the use of a straight mineral, steam cylinder oil.

In circular or tubular knitting machines a point where careless selection and application of the lubricant may cause trouble is on the roll take-ups and worm gear attachments which serve to keep the fabric under uniform tension during knitting. For this service a highly refined mineral oil should always be used in order to eliminate excessive loads upon the needles as well as to prevent gumming.

Were the oil to gum and become relatively stiff the rollers would work sluggishly and abnormal wear would be apt to occur, not to mention the increase in power consumption. It is, therefore, advisable to watch such mechanisms carefully and even though the best grade of oil is used, to remove and rinse them in kerosine about once every month to insure that they are perfectly clean and free from gummed oil or accumulated dust and lint.

To prevent oil spots on the fabrics, needle cylinders and dials on certain of the circular knitting frames must also be oiled carefully. Self-feeding oil cups are sometimes installed on the machines for this purpose but owing to their positive action, unless promptly turned off whenever the machine is stopped, they will tend to flood the working parts and cause serious oil spots or even streaks. Any device which will function only when the machine is operating is advantageous in this regard.

LUBRICATION OF DRYER BEARINGS

In the development of textile finishing machinery dryers have been studied from the viewpoint of adaptability of the anti-friction

bearing of either ball or roller type to the main shafting of the machines. There may be a potential problem in the lubrication of such bearings, due to the possibility of entry of acids into the bearings of the ager machines, or the viscosity reducing effects of temperature, due to the practice of passing the steam through hollow shafting of dryers.

Most recent practice in the design of aging machines is to locate all bearings externally, in order to eliminate, as far as possible, contact with acids. Acetic acid is used extensively in aging operations, in dilute or vaporous form it has a particularly corrosive action upon highly polished steel surfaces.

Use of the seal type ball bearing, with provision for grease lubrication, has been found to prevent entry of such acids into the interior of the bearing. Where oil is used it should be remembered that if it leaks out there would be no seal remaining against the detrimental effects of any acids that might gain entry. Bearings for oil lubrication should, therefore, be studied carefully from an oil retention point of view.

The roller bearing, in turn, has been found to be very adaptable to shaft bearings of aging machines. General practice in the lubrication of such bearings is to resort to a comparatively high melting point grease, prepared from an oil of considerable viscosity. This latter should be in the neighborhood of 175 seconds Saybolt at 210 degrees Fahr. The possibility of leakage must be taken into consideration for under the prevailing temperatures, which may range considerably above 225 degrees Fahr., it is obvious that if the grease becomes thinned down to any marked extent it might leak out. For this reason it is the opinion of certain builders that it would be well to eliminate the use of fixed pressure gun fittings in an effort to control more accurately the amount of grease charged into these bearings at the time of relubrication.

Normally it might be expected that if such bearings are relubricated at approximately monthly intervals adequate protection will be maintained.

Lubrication of Mercerizer Chains

In the average textile finishing plant chains on mercerizer frames are often lubricated solely by the caustic employed in the processing of the goods. As a general rule this will give comparatively satisfactory results in lubrication. On the other hand, it will frequently involve high starting torque and marked increase in power consumption. To overcome this objection study has been made of the application of the mechanical force feed lubricator, equipped with two flexible feed lines which extend to the underside of the rail on each side of the frame. These feeds serve to lubricate the bottom of the chain as it runs over or is guided along the rail. The top of the chain is lubricated about once every shift by pouring oil in a fine stream while the frame is running. These combined methods have been found to be highly satisfactory in reducing starting torque and the amount of chain link and pin wear which would normally occur when caustic is depended upon for lubrication.

Splashing of caustic over the chain will often have the added effect of formation of a type of soft soap. This may be somewhat of an advantage in that any oil which may drain into the caustic solution in the tank will be absorbed therein and show no tendency to stain the fabric which is being mercerized.

The type of oil which has been found most satisfactory for this purpose is a comparatively colorless, highly refined, light viscosity product.

CONCLUSION

The purpose of the above article has been to draw attention to the fact that control of lubrication in the textile industry is rapidly becoming an inherent part of machine design and plant maintenance. Controlled lubrication, in turn, provides the mill operator with a means of controlling other factors which, unless controlled, would seriously impair the performance of certain types of lubricants and ultimately the productive efficiency of the machinery involved.

The active interest of machinery builders in this problem of protecting equipment, reducing oil stains, and increasing mill economies by employing improved means and methods of lubrication, and whenever practicable, automatic lubrication, is most commendable, for, however carefully a machine may be built, it cannot function effectively if its moving parts are not protected by adequate lubrication.

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(*Continued From Inside Front Cover*)

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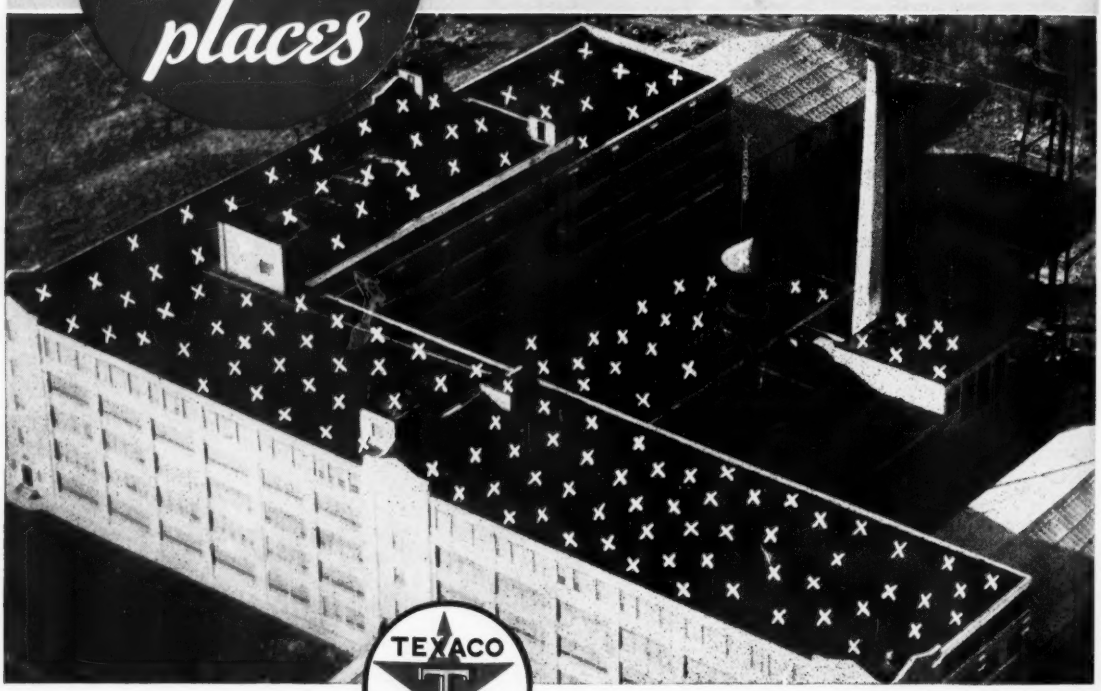

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